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Procedia Engineering 15 (2011) 4089 – 4093

**Procedia  
Engineering**[www.elsevier.com/locate/procedia](http://www.elsevier.com/locate/procedia)**Advanced in Control Engineering and Information Science**

# Opening Modular Experiment Teaching in Engine Speciality

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## Abstract

Cultivating innovative talents is an important task of colleges and universities. It is the trend of higher education development and the need of social development. Experiment teaching is an important link to develop students' practice ability as well as innovative ability and the opening modular experiment teaching is an effective way to train innovative talents. The content, conduct, effect and significance of opening modular experiment teaching were studied in detail based on modular experiment course of engine.

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**Keywords:** opening; modular; experiment teaching; practise ability; innovative ability

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## 1. Introduction

With the highly development of our nation economy, the competition between foreign corporations and domestic corporations, and the competition among domestic corporations become more and more fierce. The master of the same industry advanced technology is the basic of each corporation development. Creative ability of technology is the road of each corporation development. Therefore, the graduates who have innovation consciousness, innovation ability, creative ability and practice ability is the need of each corporation. With China's higher education continuously reform and the needs of the employing corporations, based on training students' innovative spirit and practice ability has become one of the main

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development direction of China's higher education. It is the demand of social development, universities development and the discipline development. It is the need of students' own development.

Practical teaching segment is an important link for training students' practice ability and innovation ability, and experimental teaching is one of the important parts. Experiment teaching can give the human by the scientific knowledge and technology, and cultivate students' teaching practice and innovation consciousness which can't achieve in theory. The traditional experimental teaching which is mainly instruction and demonstration by teachers t now have not adapted to the talent training requirements. While open modular experiment teaching model accord with new teaching mode of the innovative talent training, which can realize the opening of the centralized modular of the professional knowledge, experimental site, experimental instruments, experimental time, and realize students' as the core of the experimental teaching [1-6].

The China's quantity of auto production and sales is first in the world in 2009. Automobile has gradually become an indispensable tool in life. Mastering certain automobile specialized knowledge has become necessary in people's life. The open courses of automobile engine open modular experiment teaching not only meet the student demand for automotive expertise, but also develop practical and innovative ability of students, meeting the needs of creative talents. The content, conduct, effect and significance of opening modular experiment teaching were studied in detail based on modular experiment course of engine.

## **2. The content of open modular experiment teaching**

Open modular experiment teaching is a kind of teaching organization form which students can choose their experiment content, experiment time and experimental teachers. Automobile engine modular experiment class is applied this teaching mode. Engine modular experiment class is a public elective course which is opened by Shandong University of Technology. It is an elective course to each students of university. The class consists of 10 professional experimental composition of engine speciality. It has features of experiment content modular and experimental process opening.

### *2.1. The modular of engine modular experiment class*

The content of engine modular experiment class includes many courses' experiments of the engine professional direction. In order to make students master relevant knowledge faster and easier, the method of teaching is opening modular experiment teaching. Modular of experiment is shown in figure 1. The content of course is divided into professional knowledge teaching module and professional experiment teaching module. Professional experiment teaching module is divided into basic experiment module and comprehensive experiment module which are based on the difficult of experiment and the different requirements of the students' practical ability. This course is to each students, students haven't basic knowledge of engine. Therefore the purpose of professional knowledge teaching module is added professional knowledge for students with corresponding professional basis and laying good foundation knowledge of their experimental operation.

The content of course comprise 10 typical experiments. According to the guiding ideology of progressive approach, content is divided into basic experiment module and comprehensive experiment module. Basic experiment module consists of four experiments. Comprehensive experiment module consists of six experiments. Experiment module is vertical model arrange. Basic experiment module is finished firstly. Comprehensive experiment module is finished lastly. Thereby realize the knowledge from shallow to deep, from simple to complex, benefit students understanding of knowledge. Practice ability of students is improved gradually. This course experiments includes the key experiment of backbone course

instructor on engine, which can provide a platform for students to fully understand and master the engine relevant knowledge.

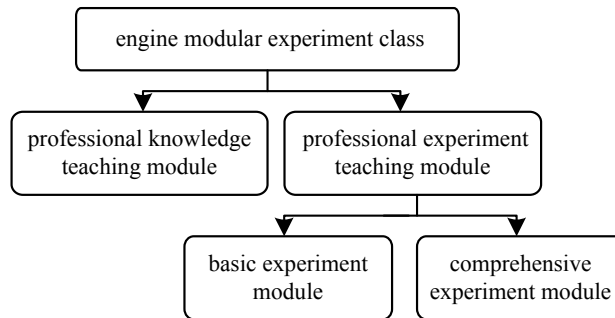


Fig. 1. Modular schematic diagram of experiment

## 2.2. The opening of engine modular experiment class

Engine modular experiment class is a public elective course which. It realizes opening at class object, experiment content, experiment time, experimental teachers, etc.

The opening of class object. The traditional major experiments are only for this specialized student, while other major students who have interested in engine experiments can't participate. Engine modular experiment class open to each students. It has achieved the opening of class objects, provided a platform for other major students who have interested in engine experiment, and improved the utilization of experiment resources.

The opening of experiment content. Experiment content is divided into basic experiment module and comprehensive experiment module. Different modules use different opening forms. Basic experiment module is certain of basic professional experiments carefully selected by teachers. So the students can master the basic knowledge of necessary, the operation and using of common instrument, and the basic method and debug skill of experiment. This part is all required by the students, the goal is to get students to master necessary experiment skill. Comprehensive experiment module is strong comprehensive, research and design ability. According to their own interesting, the students can choose 4 experiments among the 6 experiments. The opening of experiment content can arouse student's enthusiasm effectively, and benefit the cultivation of practice ability and innovation consciousness.

The opening of experiment time. Without disturbing the normal experiment teaching, the opening time of laboratory room arrange in the evening and weekends. The experiment time of this course implement two method. One method is the opening of choosing experiment time. This is to say students can do experiments at any opening time by making an appointment. Every student can do experiments according to their own conditions. Thus achieve efficient use of time; the other method is there is no limit on the single experiment in the time length and test times. Students can finish the experiment with different duration according to their ability and do experiment operation many times. To achieve the purpose of the experiment as a standard. And make every student can effective improve their own abilities.

The opening of experiment teachers and teaching methods. The opening experiment teaching put forward higher requirement to teachers. The teachers' main task is guiding students by using elicitation teaching mode and take student's thinking primarily and provide guidelines to students. Thus develop the students' each kind of ability as much as possible. The experimental process follow after first, make students gradually deepens, and enables the student to master the ideas to solve problems. After

experiments, the students should think and summarize the experimental process of valuable content which can cultivate students' ability of summarization.

The opening of experiment teaching management. A great deal of modern education technology are used in Engine modular experiment class. such as electronic courseware, experimental video, etc. It effectively improve the utilization of electronic resources. Meanwhile, the management also realize opening. At the beginning of each semester the school will arrange the elective to all students. Students can appointment the course with their interesting. Each experiment also realizes the electronic appointments which save the time of both teachers and students. This is easy to manage and scientific.

### **3. The implementation and results of open modular experiment**

The open modular experiment teaching is not simply opening the door of laboratory. Experiment teachers have done a lot of work for this course can realize the real opening. Firstly, they have collected lots of information through kinds of ways and communicated with numbers of famous university professional experiment teachers. By using all of these ways, they put forward vertical model experiment modular teaching method and the elective model which the experiment content is full opening. Secondly, according to the new course content and class objects, the teachers have specially written experimental outline, experimental procedure, test report and so on. Besides, they have made electronic courseware, experimental video and other teaching materials. The course has realized whole school elective and electronic appointment of experiment, and got the acceptance of university functional department.

From the offering of engine modular experiment class, every semester we can begin our class, and each time the number of elective course selection number has reached the upper limit. Thus we can see great interesting to this course content among students. And they have high approval degree to this mode of course. In the feedback information of opening experiment teaching modular, Students thought highly of this course. The satisfaction rate is 98%. The students generally deem that this course let them know how to think and explore on their own. They can gain experience from the failure of the experiments, and gain achievement from the success of the experiment. As a result, they can effectively improve their ability of overcoming difficulties. Through this course students thought that expand their own aspect of knowledge, master the methods to solve the problems, improve their innovation consciousness, and give great help to the development of themselves and the study of other courses.

### **4. The significance of open modular experiment teaching**

Engine modular experiment course provide all new knowledge. For better finishing and mastering the experiment, the students should self-study the relevant knowledge, consult plenty of dates, then work out the best experiment plan. Besides, they need to hands-on experiment design and experimental operation. Therefore, it contributes to cultivate the students' self-learning ability, practical ability and expand the scope of students' knowledge.

The goal of the opening modular experiment is to reach the purpose of experiment. It needs students to design the whole experiment process. This contributes to cultivate the students' the ability of solving problems. Through the careful observation, analysis and summary in experimental process, the students can expand their thinking ways which makes the solution of the problem diversity. Thus it contributes to cultivate the students' innovation consciousness.

### **5. Conclusions**

It is a significant task for university and higher education development trend and the demand of social development to cultivate talents with innovation consciousness, innovation ability, creative ability and practical ability. Experimental teaching is an important link to cultivate students' practice ability and innovation ability. The open modular experimental teaching mode is the effective way of training innovative talents. We should promote the reform of the opening modular experiment teaching, vigorously inspire students' interest of experiment, active students' thinking, and cultivate the students' practical ability and creative ability. Finally enhance the comprehensive ability of the college graduates.

## Acknowledgements

This research was supported by Shandong University of Technology Teaching Innovation Foundation (No.107035 and No.108009)

## References

- [1] Wang M, Li J, San XM. Open teaching pattern for organic chemistry experiment. *J of Chongqing Institute of Technology(Natural Science Edition)* 2007;21:169-172.
- [2] Luo HB, Yao H, Lin XH. On the open experimental teaching in pharmaceutical speciality. *J of Fujian Medical University(Natural Science Edition)* 2008;9:34-37.
- [3] Su R. The exploration and practice of opening experiment teaching. *China Science and Technology Information* 2009;2:268-269.
- [4] Zhu HB, Dai WY, Li J. Reform and innovation of experiments teaching in engineering hydrodynamics. *J of Ningbo University(Educational Science Edition)* 2008;30:107-109.
- [5] Wang JH, Zhang D, Cang J. The exploration and practice on plant physiology open experiment teaching. *J of Northeast Agricultural University(Social Science Edition)* 2007;5:69-71.
- [6] Deng JZ, Zhang ZY, Li ZL. The exploration and practice on opening experimental teaching of electricity prospecting. *J of East China Institute of Technology(Social Science)* 2007;26:76-79.